FIBER-REINFORCED PLASTIC MOLDED ARTICLE, ITS PRODUCTION METHOD AND A MOLDING MOLD USING THAT METHOD

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a fiber-reinforced plastic molded article having stable surface smoothness with respect to temperature changes as well as superior blistering resistance, and relates to its production method and a molding mold equipped with the fiber-reinforced plastic molded article.

2. Description of Related Art

Fiber-reinforced plastic molded articles are provided with a cured layer of a gelcoat resin as necessary for the purpose of obtaining design properties (coloring, pattern formation), weather resistance, hot water resistance, chemical resistance and stain resistance. Said cured layer is formed in the form of a cured film having a thickness of about 0.3 to 0.5 mm by spraying at normal temperature onto a mold a curable resin composition including unsaturated polyester, epoxy(meth)acrylate, urethane(meth)acrylate, or their mixture, polymerizable unsaturated monomer, curing accelerator, curing agent, pigment, and so forth, as necessary according to the application and performance level, followed by obtaining a molded article by curing a fiber-reinforced plastic layer laminated in the next step together with integrating into a single unit.

As an example of a typical method for obtaining molded articles in the case of molding this fiber-reinforced plastic molded article, molding is normally carried out by hand lay up molding or spray up molding, and a polymerizable unsaturated resin composition able to be cured at normal temperature is impregnated using a degassing roller into chopped strand mat and/or roving cloth, etc. having a fiber length of about 2 inches in the case of the former molding, or into about 1 inch chopped strand in the case of the latter molding, followed by curing and demolding.

At that time, when curing shrinkage of the fiber-reinforced plastic layer is observed from a microscopic viewpoint, differences occur in curing shrinkage between the vicinity of the fiber-reinforced material and resin-rich sections. As a result, even if a gelcoat resin

layer is coated with said fiber-reinforced plastic layer, the problem of appearance defects occurs that are referred to as print through of the fiber pattern in which the orientation pattern of the fiber-reinforced material lifts away from the gelcoat resin surface in the form of surface irregularities. These appearance defects, which impair the surface smoothness of molded articles, may be corrected by polishing and so forth depending on their degree, and a considerable amount of time and labor are required for their correction. In addition, even if the surface of the cured gelcoat resin layer is smooth immediately after demolding, the surface smoothness of the molded article may be impaired due to progression of curing of the fiber-reinforced plastic layer.

Since the above gelcoat resin normally contains 5 wt% or less of filler, the above problem of appearance defects caused by print through of the fiber pattern cannot be solved. In addition, if a large amount of filler is contained, the problem occurs in which the required attractiveness of the outermost layer of the fiber-reinforced plastic molded article as a gelcoat layer is impaired.

In addition, the inventors of the present invention conducted studies for improving the surface smoothness of molded articles by adding as low profile agent a thermoplastic plastic such as polystyrene or vinyl polyacetate, or by using the low shrinkage dicyclopentadiene-based unsaturated resin composition described in Japanese Unexamined Patent Application, First Publication No. 4-198209.

However, when a thermoplastic polymer is added as a low profile agent, due to the poor compatibility between the polymerization cured unsaturated resin composition and thermoplastic polymer, separation of the thermoplastic polymer occurs which prevents the obtaining of a uniform cured product.

In addition, in the case of using a low shrinkage dicyclopentadiene-based unsaturated resin composition, surface smoothness is greatly affected by molding conditions such as laminated thickness, molding temperature and amount of time from completion of lamination to demolding all at once. Moreover, in the case curing is insufficient at the time of demolding, the surface smoothness of the molded article worsens over time in the same manner as conventional unsaturated resin compositions.

Moreover, depending on the application, although there are cases in which a coating material such as a colored acrylic urethane coating is applied to the exterior of a gelcoat resin layer in order to obtain higher visual quality in terms of high design properties and

high weather resistance once a molded article has been fabricated, in such cases as well, the problem occurred in which the visual surface smoothness of the product after coating becomes inferior due to deterioration of surface smoothness of the cured gelcoat resin layer of the molded article.

Typical fiber-reinforced plastic molded articles are obtained by a lamination molding method using a molding mold made of fiber-reinforced plastic including a cured gelcoat resin layer and a fiber-reinforced plastic layer. However, in the same manner as the above-mentioned problems, this molding mold made of fiber-reinforced plastic made it difficult to fabricate a molding mold made of fiber-reinforced plastic having a high surface smoothness due to curing shrinkage of the fiber-reinforced plastic layer on the bottom of the cured gelcoat resin layer. Since visual quality and surface smoothness of molded articles are affected by the surface condition of the molding mold, if a molded article is fabricated using a molding mold in which surface smoothness has been impaired, a molded article is obtained in which the surface smoothness is impaired since the surface of that molding mold is transcribed to the surface of the molded article. Consequently, molded articles having high surface smoothness are fabricated by correcting the surface of the resulting molded articles by polishing. However, since the surface condition of a molding mold itself made of fiber-reinforced plastic changes accompanying changes in temperature during hot molding or molding accompanied by generation of heat from curing, the surface smoothness obtained by that polishing is impaired and as a result, molded articles are obtained in which surface smoothness is impaired. Consequently, there is a need for a fiber-reinforced plastic molding mold in which the surface is not affected by temperature changes.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a fiber-reinforced plastic molded article having stable surface smoothness with respect to changes in temperature. Another object of the present invention is to provide a fiber-reinforced plastic molded article having stable surface smoothness with respect to changes in temperature as well as stable surface smoothness with respect to fluctuations in molding conditions. Another object of the present invention is to provide a fiber-reinforced plastic molded article having superior surface smoothness that is not affected by changes in temperature that is able to prevent